

WHAT IS CLAIMED IS:

- 3bA2 1. Apparatus for shaping a selected end region of a hollow cylindrical glass tube used in the manufacture of optic fibers comprising:
- a support means for holding the tube at a second region, other than the selected end region, for rotating the tube in a controlled manner;
 - a heat source adapted to supply sufficient heat to the selected end region of the tube to render it malleable;
 - an internal mold for supporting and shaping the inner surface of the selected region of the tube, when the tube is rendered malleable;
 - means for inserting said internal mold within said selected end region of the tube, prior to the application of heat to the tube; and
 - means for compressing the exterior surface of the selected end region of the tube and for shaping the exterior surface of the selected end region of the tube, when rendered malleable, and for, concurrently, causing the shape of the inner surface of selected end region of the tube to conform to the exterior surface of the internal mold.
2. An apparatus as claimed in claim 1 wherein said internal mold may be selectively altered so it can assume an open, extended, configuration or a closed, collapsed, configuration.
3. An apparatus as claimed in claim 2 wherein said means for inserting said internal mold within said selected end region of the tube includes:
- (a) means for setting the mold to its extended configuration, and (b)
 - means for setting the internal mold to its collapsed configuration for

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withdrawing the mold from the tube through an opening in the selected end region.

4. An apparatus as claimed in claim 3, wherein setting the internal mold to its collapsed configuration causes the internal mold to occupy a small volume in order to enable the mold to be easily retracted from the selected tube end.
5. An apparatus as claimed in claim 1, wherein the means for compressing the exterior surface of the selected end region of the tube and for shaping the exterior surface of the selected end region of the tube includes manual means for shaping the exterior end region of the tube.
6. An apparatus as claimed in claim 1, wherein the means for compressing the exterior surface of the selected end region of the tube and for shaping the exterior surface of the selected end region of the tube includes an actuatable mechanical holding means for holding an exterior mold and for selectively applying the exterior mold to the outer periphery of the selected end region of the tube, when the tube is rendered malleable, for shaping the exterior of the selected end region

of the tube while the internal mold supports the inner walls of the tube and controls the shape of the inner diameter of the tube.

7. Apparatus for shaping a selected end region of a hollow cylindrical glass tube used in the manufacture of optic fibers comprising:

a support means for holding the tube at a second region, other than the selected end region, for rotating the tube in a controlled manner;

a mold for shaping the inner surface of the selected end region of the tube, said mold being selectively settable to an open, extended configuration or a closed, collapsed, configuration;

means for inserting said variable configuration mold within said selected end region of the tube and for setting the mold in its extended configuration; said mold, when inserted in the selected end of the tube and when in its extended configuration, for shaping the inner surface of the selected end region of the tube;

a heat source adapted to supply sufficient heat to the selected end region of the tube to render it malleable; and

means for compressing the exterior surface of the selected end region of the tube, when rendered malleable, and for, concurrently, causing the shape of the inner surface of the tube to conform to the exterior surface of the molding means.

8. An apparatus as claimed in claim 7 wherein said means for inserting said mold within said selected end region of the tube also includes means for setting the mold to its collapsed configuration for

withdrawing the mold from the tube through an opening in the selected end region.

9. An apparatus as claimed in claim 8, wherein setting the variable configuration mold to its collapsed configuration causes the mold to occupy a small volume to enable the mold to be easily withdrawn from, and through, the narrowed selected end region of the tube.

10. An apparatus as claimed in claim 9, wherein said means for compressing the exterior surface of the selected end region of the tube includes an actuatable mechanical holding means for holding a multi piece exterior shaping mold for selectively applying the exterior shaping mold to the selected end region of the tube, when the tube is rendered malleable, for shaping the selected end region of the tube in conjunction with the variable configuration mold.

11. An apparatus as claimed in claim 10, wherein said exterior shaping mold includes two side pieces for imparting an oblate, cone-like shape to the inner and outer diameters of the tube along its selected end region while leaving an opening between the mold pieces for enabling the withdrawal of the variable configuration mold when set to its collapsed condition.

3613 12. An apparatus as claimed in claim 11 further including sensing means for sensing the temperature of the selected end region of the tube.

13. An apparatus as claimed in claim 12 wherein the temperature sensing means is a pyrometer producing an actuating signal coupled to the

actuatable mechanical holding means when the temperature of the selected end portion is such that the end portion is in a malleable state.

14. An apparatus as claimed in claim 13 wherein the heat source is a torch and wherein said actuating signal produces a signal for removing the torch when the exterior shaping mold is applied to the selected end portion of the tube.
15. An apparatus as claimed in Claim 14 wherein said sensing means for sensing the temperature controls the intensity of the heat source applying heat to the selected end portion of the tube.
16. An apparatus as claimed in Claim 8 wherein the tube is a first tube and wherein the variable configuration mold and the exterior shaping mold shape the opening of the first tube to enable a second tube to be inserted snugly within the first tube, while the first and second tubes can be easily aligned to have a common center line.
17. An apparatus as claimed in Claim 7, wherein the support means is a lathe.
18. An apparatus as claimed in Claim 7 further including optical sensing means for sensing the condition of the tube.
19. A method for shaping a selected end of a hollow cylindrical tube comprising the steps of:
positioning the tube within a support means and rotating the tube;

inserting an internal mold within the selected end region of the tube to support the tube end when the tube is being shaped and for controlling the shape of the inner surface of the tube end;

heating the selected end of the tube with a heat source until the selected end becomes malleable; and

compressing the exterior surface of the selected end region of the tube for concurrently shaping the exterior and inner surfaces of the selected end region of the tube into a predetermined form.

20. A method as claimed in claim 19, wherein the internal mold is settable to an extended, open, configuration or to a collapsed, closed, configuration, and wherein the step of inserting the internal mold includes the step of setting the mold to its open configuration before and during the time heat is applied to the selected end of the tube.

21. A method as claimed in claim 20, wherein the step of compressing the exterior surface of the selected end region of the tube for concurrently shaping the exterior and inner surfaces of the selected end region of the tube includes the step of applying an external mold to the selected end of the tube when the end segment becomes malleable.

22. A method for shaping the opening and end region at a selected end of a cylindrical tube comprising the steps of:

